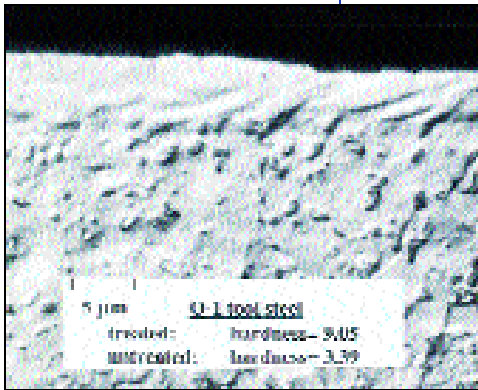


... a process that may be able to harden synthetic knee joints to make them last longer inside the body.

QM TECHNOLOGIES
IS WORKING WITH
MORE THAN A DOZEN
COMPANIES TO VALIDATE
INDUSTRY APPLICATIONS
FOR IBESTSM TECHNOLOGY.



■ This cross-sectional view of a steel tool sample shows the effects of rapid surface melting and cooling using IBESTSM technology.

MATERIAL HARDENING PROCESS REDUCES TOOL-AND-DIE WEAR

For years, tool-and-die makers toughened their products using such processes as heat treatment and flame hardening. While these processes were highly effective, the growing demand for extreme precision in manufacturing new products made assembly lines and small precision fabrication shops much less tolerant of tool wear.

Spinning off technology from Sandia National Laboratories (Albuquerque, NM), QM Technologies, Inc. (same location), licensed and markets a material-improvement technology called IBESTSM, or ion beam surface treatment. IBEST, an environmentally friendly pulsed ion beam process, can provide longer lasting, more wear- and corrosion-resistant materials for the tool-and-die industry, which the Association for Manufacturing Technology and the U.S. Department of Commerce estimated at \$4.5 billion in 1994. BMDO-funded research in pulsed power technology enabled IBEST's development.

IBEST's benefits extend far beyond tools and dies. "Materials and surfaces are where everybody's problems are . . . everybody is up against the limit," comments Regan Stinnett of QM Technologies. Other industries, such as automotive and medical manufacturers, can also use IBEST for hardening materials. In the future, biomedical manufacturers may be able to use IBEST to treat synthetic knee joints (typically composed of a metal ball inside a plastic socket), which now have limited lifetimes inside the body. Treated knee joints would wear out less quickly, drastically reducing or eliminating replacement surgeries, which now typically occur every 7 to 10 years. QM Technologies is working with more than a dozen companies to validate industry applications of the technology.

QM Technologies obtained the exclusive worldwide rights to the patented IBEST technology from Sandia National Laboratories. Through a Cooperative Research and Development Agreement with Sandia and ongoing relationships with Cornell University and Applied Pulsed Power, the company continues to develop IBEST technology. In addition, the Technology Venture Corporation, a nonprofit organization for commercializing technology from national laboratories and research universities in New Mexico, helped QM Technologies obtain over \$4 million in venture capital from Rainbow Technologies Inc.

ABOUT THE TECHNOLOGY

IBEST uses high-energy, pulsed (typically less than 500 nanoseconds) ion beams to heat the surfaces of a material. Because of the pulsed nature of these beams and the rapid cooling rates of the surface-heated material, only very thin surface layers (2 to 20 microns) of the material are rapidly melted and cooled; this process helps form amorphous and nanocrystalline grain layers without altering the atomic composition of the material.

The Repetitive High-Energy Pulsed Power (RHEPP) accelerators deliver the unique combination of high average power and short-duration electrical pulses required for high-efficiency IBEST systems. A magnetically confined anode plasma (MAP) diode generates the short pulse of ions using the RHEPP accelerator power pulse. The electrical pulse, applied to a pre-ionized gas in the MAP diode, extracts ions from the plasma. The ions then travel through a vacuum to the material surface. The IBEST ion beam cover areas up to 200 cm² with each pulse. The RHEPP I accelerator was initially developed for the Department of Energy's inertial confinement fusion experiments and BMDO's free-electron laser weapons system.